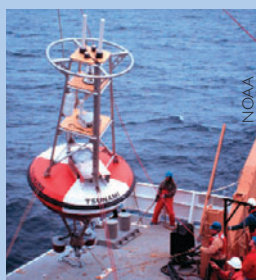


# Tsunami Warning System

Governments around the world worked with Indian Ocean officials to plan a warning system that might save tens of thousands in future tsunamis.



## System Features

- Deep sea tsunameters detect tsunamis
- Tsunameters send signal to tethered buoy
- Buoy signals satellite
- Satellite signals tsunami center in Hawaii
- Center charts path of waves and warns target zones
- Regional authorities alert population by radio, telephone, siren and local police
- Relief agencies prepare to cope with damages

To prevent another massive loss of life, experts from Asian and other countries met in Tokyo, Phuket and Paris after the December 26 disaster to extend a tsunami warning system, now functioning in the Pacific region, to protect the Indian Ocean.

On March 9, three months after the tsunami, the U.N. Intergovernmental Oceanographic Commission (IOC) and experts from around the world agreed to set up the system by 2006.

The \$950 million for tsunami relief President Bush said he would seek from Congress includes \$23 million to improve the international and U.S. tsunami early warning system, and \$12 million for tsunami warning and disaster mitigation in the affected countries.

By March 27, new measures to share information on earthquakes and possible tsunamis proved effective when a powerful 8.7 magnitude earthquake hit off Sumatra, just 100 miles away from the epicenter of the giant 9.0 December 26 quake.

The Pacific Tsunami Warning Center in Hawaii informed disaster experts in Indonesia, Thailand, Sri Lanka, India and Malaysia who then spread the word through the media and the public authorities. Police, soldiers, monks, fishermen and residents of coastal areas across the Indian Ocean used megaphones, radio, telephones and temple bells to warn of the possibility of another tsunami.

While early reports indicated more than 1,000 were killed on Nias Island off Sumatra by the earthquake, no tsunami hit land. However many thousands of people did move away from the sea shore to higher ground in Indonesia and nearby countries—an effective measure that could have saved tens of thousands of lives had it been done after the 2004 earthquake.

The Tsunami Warning System includes 26 countries and was created 40 years ago to protect the Pacific Rim countries after an 8.4 magnitude earthquake—biggest ever in North America—struck Alaska in 1964, setting off a tsunami that killed 119 people.

The warning system consists of a series of undersea sensors known as tsunameters

placed 1,000 kilometers (625 miles) apart on the ocean floor in deep water in a huge semicircle off the coasts of Pacific countries. These instruments detect the movement of tsunamis and transmit a signal to a buoy at the surface which then communicates with tsunami centers in Hawaii, Alaska and the U.S. mainland.

Seismographs give the first warning when they detect undersea quakes above magnitude 8, powerful enough to generate tsunamis. However most of these quakes do not produce tsunamis so ordering evacuations without confirmation from tsunameters is costly, wasteful and produces eventual disbelief that dangers are real.

Once instruments detect real likelihood of a tsunami, centers in Hawaii and Alaska warn local, state, national and international users as well as the media. The U.S. National Oceanic and Atmospheric Administration

sist of 30 seismographs to detect earthquakes, 10 tidal gauges and six deep-sea detectors—costing \$20 million.

If individual countries wanted to place tsunameters closer than 1,000 kilometers apart for greater safety in earthquake-prone areas, that cost could increase.

At the IOC meeting in Paris, the following decisions were taken:

- The United States and Japan agreed to share reports on earthquakes from their existing warning system in the Pacific with Indian Ocean countries.

- About 20 tidal gauges were to be installed or upgraded near Thailand, Indonesia and Malaysia.

- By the end of 2006, a regional warning center will be built, with links to a network of gauges and underwater sensors.

Education is another vital part to saving lives in future tsunamis. In schools, the me-

## A series of undersea sensors known as tsunameters are placed 1,000 kilometers apart in deep water on the ocean floor, tied to buoys.

also broadcasts warnings and is exploring a system of warnings to cell phone users. On March 28 when the earthquake hit off Sumatra, some residents of Banda Aceh got text messages on their cell phones warning them to evacuate coastal areas.

Since the tsunami that killed about 200,000 in Banda Aceh took only 15 minutes to hit the city after the Dec. 26 quake, a swift and effective system to spread warnings and evacuate people must be set up by every country in their coastal regions. This could involve media but also sirens.

An Australian design for an early warning system for the Indian Ocean would con-

dia and public meetings, all those living near the sea must be taught the warning signs of a possible tsunami such as earthquakes or changes in sea levels.

In Thailand, a 10-year-old English tourist, who had learned in school the previous month about tsunamis, saw the water retreating and told his parents it meant a tsunami was coming. They alerted the hotel and all guests and staff evacuated to high ground, surviving the tsunami when it hit.

The public must also learn how to evacuate crowded areas swiftly and efficiently, and how to identify the nearest practical places of refuge.